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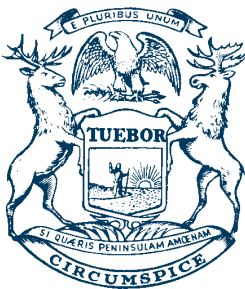
AUDIT REPORT

PERFORMANCE AUDIT
OF THE

BRIDGE INSPECTION PROGRAM

MICHIGAN DEPARTMENT OF TRANSPORTATION

March 2015



Doug A. Ringler, CPA, CIA
AUDITOR GENERAL

The auditor general shall conduct post audits of financial transactions and accounts of the state and of all branches, departments, offices, boards, commissions, agencies, authorities and institutions of the state established by this constitution or by law, and performance post audits thereof.

– Article IV, Section 53 of the Michigan Constitution

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Report Summary

Performance Audit

Bridge Inspection Program

Michigan Department of Transportation

Report Number:
591-0169-14

Released:
March 2015

The Michigan Department of Transportation (MDOT) must ensure the biennial inspection of all bridges under its jurisdiction in accordance with State law. Also, MDOT must ensure that all State-owned and locally owned bridges that are longer than 20 feet are inspected in accordance with various federal requirements. MDOT delegated responsibility for inspecting locally owned bridges to their respective owners, including cities, villages, townships, and counties. As of April 30, 2014, 5,895 State-owned and 6,500 locally owned bridges required inspection at least every two years.

Audit Objective			Audit Conclusion
Objective: To assess the effectiveness of MDOT's efforts to ensure that its Bridge Inspection Program complies with State and federal requirements related to staff qualifications and inspection processes.			Moderately effective
Findings Related to This Audit Objective	Material Condition	Reportable Condition	Agency Preliminary Response
MDOT should consider seeking amendatory legislation to establish risk-based bridge inspection frequencies. Also, MDOT should consider seeking Federal Highway Administration approval to lengthen the inspection intervals for State-owned and locally owned bridges or categories of bridges that warrant longer intervals, as determined through analysis of available inspection and other data. These changes may significantly improve the efficiency of MDOT's Bridge Inspection Program by allowing for the allocation of State and local resources to other priorities (Finding 1).		X	Agrees
MDOT did not ensure that the plans of action developed for scour critical bridges contained all recommended information. Comprehensive plans of action would better establish specific action to take during flood events to maximize public safety and ensure the most efficient use of State and local resources (Finding 2).		X	Agrees

Findings Related to This Audit Objective (Continued)	Material Condition	Reportable Condition	Agency Preliminary Response
MDOT had not instituted a sufficient process to ensure that inspectors consistently increased the bridge inspection frequency for each structurally deficient bridge or documented an acceptable rationale for not doing so. As a result, some bridges may not have been inspected as often as necessary. Ensuring that structurally deficient bridges are inspected with sufficient frequency is important for maintaining the safety and confidence of the traveling public and for effectively managing the condition of the valuable assets (<u>Finding 3</u>).		X	Agrees
MDOT had not implemented sufficient measures to ensure that local bridge owners and MDOT regional offices completed all routine inspections, inspections of the underwater structural elements of bridges, and fracture critical member inspections in accordance with time frames established in State statute and National Bridge Inspection Standards (NBIS). Also, MDOT did not sufficiently document some of its follow-up actions related to late or potentially late bridge inspections. Timely inspections help to ensure the preservation of assets and the safety of the traveling public (<u>Finding 4</u>).		X	Agrees
MDOT did not provide consistent guidance to inspectors regarding the inspection of bridges with plywood false decking. Also, MDOT did not ensure that all bridges with false decking were correctly identified in the Bridge Management System. In addition, MDOT did not adequately inspect the underside of bridges with plywood false decking. As a result of these conditions, MDOT did not consistently comply with NBIS, which was developed to help ensure the safety of the traveling public (<u>Finding 5</u>).		X	Agrees

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March 13, 2015

Mr. Jerrold M. Jung, Chair
State Transportation Commission
and
Kirk T. Steudle, PE, Director
Michigan Department of Transportation
Murray Van Wagoner Transportation Building
Lansing, Michigan

Dear Mr. Jung and Mr. Steudle:

This is our report on the performance audit of the Bridge Inspection Program, Michigan Department of Transportation.

This report contains our report summary; a description of program; our audit objective, scope, and methodology and agency responses and prior audit follow-up; comment, findings, recommendations, and agency preliminary responses; various exhibits, presented as supplemental information; and a glossary of abbreviations and terms.

The agency preliminary responses were taken from the agency's response at the end of our audit fieldwork. The *Michigan Compiled Laws* and administrative procedures require that the audited agency develop a plan to comply with the audit recommendations and submit it within 60 days after release of the audit report to the Office of Internal Audit Services, State Budget Office. Within 30 days of receipt, the Office of Internal Audit Services is required to review the plan and either accept the plan as final or contact the agency to take additional steps to finalize the plan.

We appreciate the courtesy and cooperation extended to us during this audit.

Sincerely,

Doug Ringler
Auditor General

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Description of Program

Section 254.19a of the *Michigan Compiled Laws* requires the Michigan Department of Transportation (MDOT) to institute a systematic plan of biennial inspection of all bridges (regardless of length) under its jurisdiction. Also, Title 23, Part 650 of the *Code of Federal Regulations*, referred to as the National Bridge Inspection Standards* (NBIS), requires MDOT to inspect, or cause to be inspected, all State-owned and locally owned* highway bridges longer than 20 feet that are located on public roads and are fully or partially located within the State. For both State and federal purposes, the terms bridge and culvert* are used synonymously and, therefore, are subject to the same inspection requirements. The Structure Management Section within the Operations Field Services Division administers the Bridge Inspection Program in accordance with these requirements.

The primary purpose of NBIS is to identify and evaluate existing bridge deficiencies to ensure the safety of the traveling public. NBIS governs the type, timeliness, and scope of bridge inspections and establishes requirements for bridge load ratings*, inspector training and education, quality control* and quality assurance* initiatives, recordkeeping, and other items. Two of the most common types of inspections include routine inspections* and underwater inspections*. During a routine inspection, inspectors rate a bridge's primary structural elements, which include the deck*, superstructure*, and substructure* using the 10-point National Bridge Inventory* condition rating* scale. Underwater inspections include the inspection of the underwater portion of a bridge substructure and the surrounding channel that cannot be inspected visually at low water by wading or probing and, therefore, would generally require the use of a trained diver. Other types of inspections include fracture critical member*, in-depth*, special*, damage*, and initial* inspections. Generally, each inspection includes evaluating the continued appropriateness of the bridge's load rating, which is its load carrying capacity.

MDOT's central office and seven regional offices are responsible for inspecting State-owned bridges. MDOT delegates its NBIS responsibility for inspecting all locally owned bridges to their respective owners, which include cities, villages, townships, and counties. Although NBIS allows this delegation, NBIS requires that MDOT's bridge program manager* ensure local agencies' compliance with NBIS. Both MDOT and local

* See glossary at end of report for definition.

bridge owners use in-house inspectors and private consultants to conduct their inspections.

MDOT uses MiBridge, an Internet-based application, to collect bridge inspection and bridge inventory data for storage in its Bridge Management System. MDOT also uses its Michigan Bridge Reporting System to meet various State and federal reporting requirements and its internal information needs.

As of April 30, 2014, MDOT had 4 inspectors located at its central office and 32 inspectors at its seven regional offices. Also as of April 30, 2014, MDOT records reflected that 4,477 State-owned and 6,500 locally owned bridges required NBIS inspections and 1,418 State-owned bridges required biennial non-NBIS inspections.

MDOT estimates that it annually expends \$3.5 million inspecting State trunkline bridges. For additional perspective, MDOT provided the following:

MDOT also estimates that the replacement value of State-owned National Bridge Inventory bridges, comprising 50.8 million square feet of deck, is \$14 billion. In addition to expending more than \$9 million each year reacting to maintenance situations as they arise, MDOT has expended on average over the last three completed fiscal years \$36 million providing capital preventative maintenance on bridges, \$33 million rehabilitating bridges, and \$174 million replacing bridges.

Audit Objective, Scope, and Methodology and Agency Responses and Prior Audit Follow-Up

Audit Objective

The objective of our performance audit* of the Bridge Inspection Program, Michigan Department of Transportation (MDOT), was to assess the effectiveness* of MDOT's efforts to ensure that its Bridge Inspection Program complies with State and federal requirements related to staff qualifications and inspection processes.

Audit Scope

Our audit scope was to examine the program and other records of the Bridge Inspection Program. We conducted this performance audit in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusion based on our audit objective. We believe that the evidence obtained provides a reasonable basis for our findings and conclusion based on our audit objective. Our audit procedures, which included a preliminary survey, audit fieldwork, report preparation, analysis of agency responses, and quality assurance, generally covered the period October 1, 2011 through August 31, 2014.

As part of our audit, we prepared supplemental information that relates to our audit objective. Our audit was not directed toward expressing a conclusion on this supplemental information.

Audit Methodology

The criteria used in the audit included Sections 254.19a - 254.30 of the *Michigan Compiled Laws*, National Bridge Inspection Standards (NBIS), Federal Highway Administration (FHWA) Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation's Bridges, FHWA Bridge Inspectors Reference Manual, FHWA Technical Advisories, FHWA Hydraulic Engineering Circular No. 18, The Manual for Bridge Evaluation by the American Association of State Highway and Transportation Officials, MDOT's Michigan Structure Inventory and Appraisal Coding Guide, MDOT's Guidelines for Bridge Inspection Frequencies, MDOT Bridge Advisories, MDOT's Michigan Structure Inspection Manual, and industry best practices.

* See glossary at end of report for definition.

We conducted a preliminary survey of MDOT's Bridge Inspection Program to plan our audit. This included:

- Interviewing MDOT and FHWA staff.
- Reviewing applicable State and federal laws, regulations, guidelines, manuals, and other information.
- Analyzing available records, data, and statistics.
- Conducting on-line research of industry best practices.
- Examining reports from various internal and external audits and reviews.
- Reviewing quality assurance and quality control data.
- Obtaining an understanding of selected controls over the Bridge Inspection Program.

To accomplish our objective, we:

- Selected 30 of 148 regular inspectors, 10 of 17 underwater inspectors, and 10 of 149 load raters and verified that they had the required credentials and met MDOT's continuing education requirements.
- Verified that bridge owners evaluated all bridges over water for scour* and completed a plan of action* (POA) for bridges with unknown foundations and bridges determined to be scour critical*.
- Selected 40 of 1,719 bridges with unknown foundations or determined to be scour critical and reviewed the completeness of their related POAs.
- Assessed the timeliness of all routine, underwater, and fracture critical member inspections. Also, we reviewed the sufficiency of and documentation for MDOT's follow-up actions for late and potentially late inspections.
- Selected 50 of 1,289 structurally deficient* bridges and determined whether their assigned inspection frequencies were consistent with MDOT's Guidelines for Bridge Inspection Frequencies, inspection reports contained detailed comments to support their National Bridge Inventory (NBI) ratings, and load ratings were recalculated when necessary.

** See glossary at end of report for definition.*

- Compared manually compiled records of bridges with false decking* against the Bridge Management System (BMS) to determine if all bridges with false decking were identified in BMS. Also, we selected 42 bridges with false decking and assessed whether bridge inspectors removed some or all of the false decking when completing their routine inspections of the bridges and whether the bridge inspectors correctly reported their inspection results in BMS.
- Identified the number of states that have received approval for extended inspection intervals. Also, we worked with MDOT's bridge inspection program manager (PM) to identify the number of NBI and non-NBI bridges meeting FHWA's minimum criteria for extended inspection intervals or more stringent criteria as the PM considered appropriate.
- Assessed whether MDOT had established an effective quality assurance and quality control program.
- Assessed whether MDOT had established a process for following up on critical and noncritical findings identified during bridge inspections.

We based our audit conclusion on our audit efforts as described in the preceding paragraphs and the resulting reportable conditions* noted in the comment, findings, recommendations, and agency preliminary responses section. The reportable conditions are less severe than a material condition* but represent opportunities for improvement.

When selecting activities or programs for audit, we direct our efforts based on risk and opportunities to improve the operations of State government. Consequently, we prepare our performance audit reports on an exception basis.

Agency Responses and Prior Audit Follow-Up

Our audit report contains 5 findings and 9 corresponding recommendations. MDOT's preliminary response indicates that it agrees with all 9 recommendations.

The agency preliminary response that follows each recommendation in our report was taken from the agency's written comments and oral discussion at the end of our audit fieldwork. Section 18.1462 of the *Michigan Compiled Laws* and the State of Michigan

* See glossary at end of report for definition.

Financial Management Guide (Part VII, Chapter 4, Section 100) require MDOT to develop a plan to comply with the audit recommendations and submit it within 60 days after release of the audit report to the Office of Internal Audit Services, State Budget Office. Within 30 days of receipt, the Office of Internal Audit Services is required to review the plan and either accept the plan as final or contact the agency to take additional steps to finalize the plan.

We released our prior performance audit of the Bridge Inspection Program, Michigan Department of Transportation (591-0169-08), in May 2010. MDOT complied with 4 of the 10 prior audit recommendations. We repeated 1 prior audit recommendation in Finding 5 of this audit report and rewrote 5 prior audit recommendations for inclusion in Findings 3, 4, and 5 of this audit report.

COMMENT, FINDINGS, RECOMMENDATIONS,
AND AGENCY PRELIMINARY RESPONSES

COMPLIANCE WITH SELECTED STATE AND FEDERAL REQUIREMENTS

COMMENT

Background: National Bridge Inspection Standards (NBIS) define a bridge as a structure including supports erected over a depression or obstruction, such as water, highway, or railway, that has a track or passageway for carrying traffic or other moving loads and an opening of more than 20 feet between ends. NBIS requires that inspections of bridges be completed in accordance with the inspection procedures in The Manual for Bridge Evaluation (AASHTO Manual) by the American Association of State Highway and Transportation Officials (AASHTO). NBIS also requires that each bridge be rated as to its safe load carrying capacity in accordance with the AASHTO Manual. A bridge's safe load carrying capacity is based on its current structural condition. As such, the AASHTO Manual requires that, as part of every inspection, the bridge's load rating be reviewed and updated to reflect any changes in the bridge's condition noted during the inspection.

During routine inspections, inspectors assign a National Bridge Inventory (NBI) condition rating to each of a bridge's three main structural elements. The condition ratings range from 9 (excellent condition) through 0 (failed condition). The lowest rating assigned to each of these three elements serves as the bridge's overall condition rating.

The following exhibits are presented as supplemental information in this report:

- Exhibit 1 - A map identifying the geographic area comprising each Michigan Department of Transportation (MDOT) region.
- Exhibit 2 - The Federal Highway Administration's (FHWA's) Bridge Condition Rating Guidelines as of June 1, 2014.
- Exhibits 3 and 4 - Charts and corresponding tables of the overall condition ratings of State-owned NBI bridges, by MDOT region, as of April 30, 2014.
- Exhibits 5 and 6 - Charts and corresponding tables of the overall condition ratings of State-owned non-NBI bridges, by MDOT region, as of April 30, 2014.
- Exhibits 7 and 8 - Tables of the overall condition ratings of municipality-owned and county-owned bridges, respectively, as of April 30, 2014.

- Exhibit 9 - A table of the scour ratings for State-owned and locally owned scour critical bridges as of March 28, 2014.

Audit Objective: To assess the effectiveness of MDOT's efforts to ensure that its Bridge Inspection Program complies with State and federal requirements related to staff qualifications and inspection processes.

Audit Conclusion: Moderately effective.

Factors leading to this conclusion included:

- The lack of any material conditions related to the objective and the lack of any reportable conditions related to staff qualifications.
- Reportable conditions related to risk-based bridge inspection frequencies, plans of action for scour critical bridges, inspection frequencies for structurally deficient bridges, inspection timeliness, and false decking.

FINDING

1. Risk-Based Bridge Inspection Frequencies

MDOT should consider seeking amendatory legislation to establish risk-based bridge inspection frequencies. Also, MDOT should consider seeking FHWA approval to lengthen the inspection intervals for State-owned and locally owned bridges or categories of bridges that warrant longer intervals, as determined through analysis of available inspection and other data.

These changes may significantly improve the efficiency of MDOT's Bridge Inspection Program by allowing for the allocation of State and local resources to other priorities. As discussed in Findings 3 and 4, MDOT and local bridge owners did not inspect all bridges with sufficient frequency or on a timely basis. Therefore, a risk-based approach would help ensure timely inspection of the higher risk structures without the need for additional resources.

In 1968, following a major bridge collapse in West Virginia, the Michigan Legislature enacted a law (Section 254.19a of the *Michigan Compiled Laws*) requiring MDOT to annually inspect all bridges and culverts under its jurisdiction. A 1982 amendment changed this requirement to biennial inspections. However,

since the enactment of these laws, bridge inspections have expanded from only routine inspections to include underwater, fracture critical member, in-depth, special, damage, and initial inspections, all with potentially different inspection intervals. Moreover, the poor condition of many State-owned bridges has necessitated that MDOT inspect many of its bridges more frequently than biennially. Section 254.19a of the *Michigan Compiled Laws* has not changed since 1982 to address these developments.

The aforementioned West Virginia bridge collapse also prompted the U.S. Congress to establish NBIS in 1971. NBIS Section 650.311 requires that MDOT conduct, or cause to be conducted, routine and fracture critical member inspections of all State-owned and locally owned bridges that are longer than 20 feet (NBI bridges) at regular intervals not to exceed 24 months and underwater inspections at regular intervals not to exceed 60 months. There are no federally required inspection intervals for in-depth, special, damage, or initial inspections. Also, there are no federal inspection standards for bridges that are less than or equal to 20 feet long.

In 1988, after the continued collection and analysis of bridge inventory and inspection data and advances in training and bridge inspection techniques, the U.S. Congress amended NBIS to allow state and local agencies, with FHWA approval, to lengthen their intervals for routine inspections for certain bridges up to 48 months. In 2004, Congress increased underwater inspection intervals up to 72 months, with FHWA approval. However, MDOT has not attempted to change the biennial inspection provision of Section 254.19a of the *Michigan Compiled Laws*, a necessary precursor to obtaining FHWA approval for longer inspection intervals. To obtain FHWA approval, states must adequately demonstrate, with various data and analyses, that the bridges for which they are seeking longer inspection intervals meet all FHWA restrictive criteria. For example, the bridges must have an overall NBI condition rating of fair or better, be less than 100 feet long, have vertical underclearances of at least 14 feet, and not be load posted or fracture critical (i.e., lacking structural redundancies).

FHWA informed us that, as of March 2014, 21 states had received FHWA approval to increase their routine inspection intervals and, to a lesser degree, underwater inspection intervals for designated types or groups of bridges. Included within this

group of states were the Midwestern states of Illinois and Minnesota. Illinois, which received FHWA approval for extended inspection intervals in 1995, informed us that 10,878 (40.7%) of its 26,714 NBI bridges have routine inspection intervals of 48 months. Illinois also informed us that its non-NBI bridges have routine inspection intervals of up to 72 months. Minnesota, which received FHWA approval in 2010, informed us that it had 5,947 NBI and non-NBI bridges on a 48-month inspection interval.

MDOT's bridge inspection program manager (PM) informed us that many State-owned and locally owned NBI bridges and State-owned non-NBI bridges in Michigan would be good candidates for longer routine inspection intervals. Locally owned non-NBI bridges are not under MDOT's jurisdiction or subject to NBIS and, therefore, can be inspected at any interval that the bridge owner determines appropriate. MDOT's PM informed us that traditional-type bridges and culverts whose overall conditions were in good or better and satisfactory or better condition, respectively, would be appropriate for longer inspection intervals. Using this criteria and FHWA's other criteria, the PM identified 2,478 (21.4% of all NBI bridges) State-owned and locally owned NBI bridges and 794 (73.5% of all non-NBI bridges) State-owned non-NBI bridges that would be good candidates for extended inspection intervals.

MDOT informed us that it had not previously attempted to amend the biennial inspection provision of Section 254.19a of the *Michigan Compiled Laws* because the use of risk-based inspection intervals had only recently come into mainstream use.

RECOMMENDATIONS

We recommend that MDOT consider seeking amendatory legislation to establish risk-based bridge inspection frequencies.

We also recommend that MDOT consider seeking FHWA approval to lengthen the inspection intervals for State-owned and locally owned bridges or categories of bridges that warrant longer intervals, as determined through analysis of available inspection and other data.

AGENCY PRELIMINARY RESPONSE

MDOT provided us with the following response:

MDOT concurs with the recommendation.

MDOT will consider seeking amendatory legislation to establish risk-based bridge inspection frequencies and will also consider seeking FHWA approval to lengthen the inspection intervals for State-owned and locally owned bridges or categories of bridges that warrant longer intervals.

It should be noted that the biennial inspection of bridges provides to the department, and the public, reassurance that bridges are safe and provides condition-state data that is used by a variety of department programs to calculate deterioration rates and to determine rehabilitation strategies given the overall network condition. The data used for scoping and programming of projects starts with inspection data that is collected at regular intervals. To consider extending frequencies, MDOT would need to work with the FHWA to develop specific guidelines for structure types and a range-of-condition states that would allow for extended frequencies.

In addition, per congressional direction of MAP-21 (the Moving Ahead for Progress in the 21st Century Act signed into law in July 2012), FHWA began the process of implementing a risk-based process for bridge inspection frequencies. A National Cooperative Highway Research Project (NCHRP) Report 782, NCHRP Projects 12-82 and NCHRP 12-82(01), Proposed Guideline for Reliability-Based Bridge Inspection Practices, was completed in March 2014. MDOT has begun internal discussions of a risk-based approach and has identified possible extended-frequency bridges that meet FHWA criteria. However, current state law requires a biennial inspection and MDOT will continue its efforts to comply with the law until further legislation has been approved.

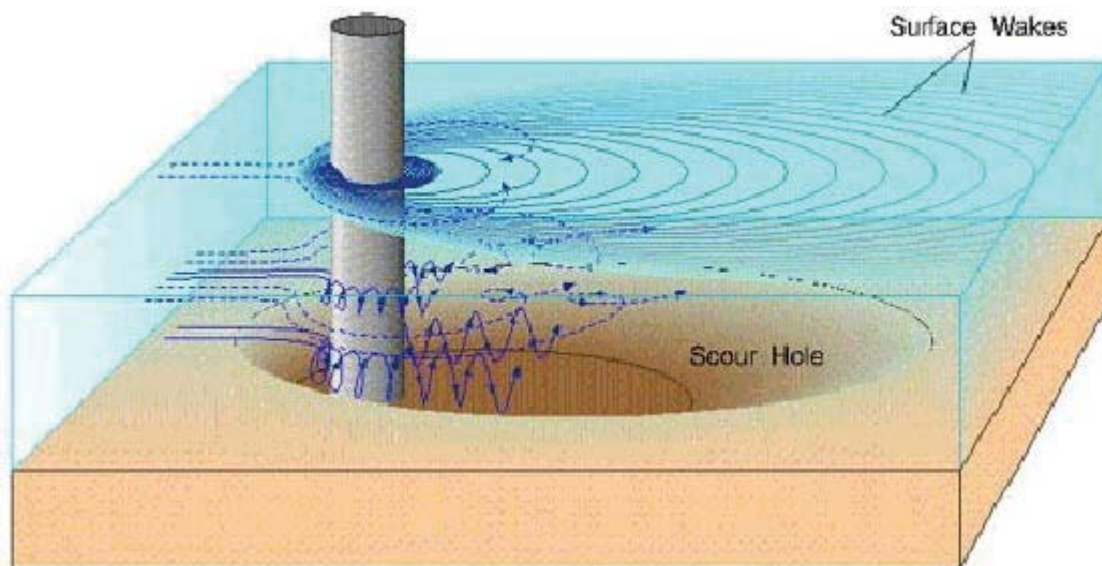
Because the current state law applies to only MDOT-owned structures, MDOT will plan to work with local agencies to implement extended bridge inspection frequencies meeting the approved requirements for local agency owned structures. In addition, MDOT will continue to work with FHWA to develop statewide requirements and procedures for extending bridge inspection frequencies for local agency owned structures.

FINDING

2. Plans of Action (POAs) for Scour Critical Bridges

MDOT did not ensure that the POAs developed for scour critical bridges contained all recommended information. Comprehensive POAs would better establish specific action to take during flood events to maximize public safety and ensure the most efficient use of State and local resources.

Scour is the erosion of the streambed or bank around bridge piers and abutments that is caused by flowing water. As flowing water causes a scour hole to grow, a bridge pier or abutment may weaken, become unstable, and cause the bridge to collapse. A bridge is classified as scour critical if its abutments or pier foundations are unstable because of observed scour or the potential for scour, as determined through calculations or modeling, or when a bridge has an unknown foundation and the potential for scour cannot be accurately determined. According to the FHWA, scour is the most common cause of bridge failure and closure.



Source: FHWA provided this illustration in its Bridge Inspector's Reference Manual, Revised December 2006.

In compliance with our prior audit finding, MDOT and local bridge owners conducted scour evaluations for bridges over water and developed POAs for bridges determined to be scour critical. The goal of a POA is to provide guidance that can be implemented for scour critical bridges before, during, and after flood events to protect the traveling public. NBIS Section 650.313(e)(3) requires bridge owners to develop a POA to monitor known and potential scour-related deficiencies for each scour critical bridge. FHWA Technical Advisory T5140.23 and FHWA Hydraulic Engineering Circular (HEC) No. 18 provide guidance to bridge owners for developing their POAs.

As of March 28, 2014, MDOT and local bridge owners classified 422 State-owned and 1,296 locally owned NBI bridges as scour critical. We reviewed MDOT's POA form, related instructions, and the resulting POAs for 40 selected bridges and noted:

- a. MDOT did not require that POAs include the specific conditions applicable to each bridge that would trigger implementation of special monitoring procedures during flood events or the type, frequency, and duration of the special monitoring procedures to be implemented. FHWA Technical Advisory T5140.23 states that POAs should include instructions for monitoring the performance of bridges, if necessary, during flood events. HEC No. 18 Sections 10.4.1 and 10.4.4 state that the specific monitoring procedures should be based on the nature and circumstances of each bridge's unique scour criticality condition and accessibility issues created by the bridge's superstructure and substructure elements.

Instead of bridge-specific monitoring triggers, MDOT's POA form included a list of generic monitoring triggers, which were not appropriate for universal application. For example, one generic trigger required bridge owners to begin monitoring when a flood warning was issued for a bridge's geographic area, regardless of the flood's forecasted severity. Although this monitoring trigger could be appropriate for some bridges, for others, a bridge owner may have determined that a bridge could withstand moderate flooding without an increased danger to the traveling public. In this instance, monitoring during lesser flood events would be an inefficient use of the bridge owner's limited resources as it often included stationing one or more individuals at the applicable bridge to monitor the bridge using methods delineated in the POA.

- b. MDOT did not ensure that POAs identified the specific conditions necessitating a bridge's closure during a flood event. HEC No. 18 Section 10.1 states that POAs should include critical guidance for identifying flood conditions that will trigger the closing of a bridge to reduce the risk to the traveling public. Although the POA form included a checklist of five conditions that were identifiable by visually monitoring a bridge during a flood event (e.g., high debris accumulation and water above the bottom cord of the bridge) and an "other" category with space for input by the bridge owner, only 6 (15.0%) of the 40 POAs that we reviewed included any "other" bridge-specific closure conditions. Frequently, POAs identified other conditions (e.g., actual or potential scour) that could cause problems with the related bridge's foundation and that could not be effectively monitored through observation alone; however, the conditions were not cited as a reason for bridge closure. MDOT stated that it relied heavily on engineering judgment when evaluating bridges for closure during flood events.
- c. MDOT did not require that POAs include the specific actions to immediately close a bridge when an unsafe scour condition was detected or was expected to occur or the criteria necessary for reopening a bridge after closure. HEC No. 18 Section 10.4.1 states that to protect the traveling public, a POA must describe the specific actions that an inspector must take immediately when he or she detects an unsafe scour condition. Instead, MDOT only required POAs to include the names and telephone numbers of the individuals responsible for closing the bridge. MDOT also required that bridge owners maintain a predetermined emergency response/incident management plan to be activated when a bridge must be closed. However, 11 (27.5%) of the 40 POAs did not identify the individuals to contact to close a bridge. Also, MDOT informed us that it did not verify if bridge owners maintained the required emergency response/incident management plans.
- d. MDOT did not ensure that bridge owners completed or documented the completion of bottom cross section elevations for 9 (22.5%) bridges or identified the recommended frequency for completing future bottom cross section elevations in the POAs for 20 (50.0%) bridges, as required by MDOT Bridge Advisory BA-2008-05. According to HEC No. 18 Section 10.3.7, the single most important aspect of inspecting a bridge for actual or potential damage from scour is measuring and plotting stream bottom elevations in

relation to the bridge foundation and comparing successive measurements for evidence of problematic changes.

MDOT informed us that its POA form was a first step toward meeting federal scour-related requirements and acknowledged that POA development and monitoring continues to be an evolving process.

RECOMMENDATION

We recommend that MDOT continue to implement measures to ensure that the POAs developed for scour critical bridges contain all recommended information.

AGENCY PRELIMINARY RESPONSE

MDOT provided us with the following response:

MDOT concurs with the recommendation.

MDOT agrees that refinements of the POAs are needed to ensure the most efficient use of MDOT and local agency resources. Prior to the Office of the Auditor General audit, MDOT had already begun to modify its pre-2011 POAs in consideration of the current (2012) HEC manual. MDOT has been in the process of updating and modifying scour POAs to take into account revisions to federal standards and applicable changes to each bridge site, such as the installation of scour countermeasures and/or the replacement of the bridge. The function of the MDOT Scour Committee, which reports to the Statewide Bridge Committee, is to develop and implement policy related to the effective management of scour critical bridges. Evolution and modifications of the POAs are a continuous and on-going effort of the committee.

MDOT has already taken the following actions regarding scour critical bridges:

- MDOT has completed scour evaluations and developed initial POAs for all State-owned scour critical bridges, and has also assisted local agencies in doing the same for locally owned bridges.*
- MDOT and local agencies have continued to monitor scour critical bridges and, in many cases, have closed structures based on flood events. These bridges were closed as a precautionary measure to protect the public. The*

bridge closures have been a direct result of efforts by MDOT and local agencies to evaluate and monitor the scour criticality of higher-risk structures.

- *MDOT issued the Michigan Structure Inspection Manual (MiSIM), which includes a section on scour critical bridge inspections that provides clarification of scour and scour inspections.*

MDOT will also be taking the following actions regarding scour critical bridges:

- *The MDOT Scour Committee is in the process of updating a guidance document for scour, which includes coding and rating requirements for scour criticality and a description of how ratings are impacted by the implementation of scour countermeasures. The guidance document is expected to be issued by June 30, 2015.*
- *The MDOT Scour Committee is currently working on revising its POA form to include all FHWA-recommended information. By December 31, 2015, the revised POA forms will be incorporated into MDOT's MiBRIDGE Web application.*
- *MDOT will continue to enhance the scour POA to include additional items to meet the minimum requirements as defined by FHWA. By December 31, 2015, additional guidance will be developed and sent to the local agency bridge owners to clarify the minimum requirements as the requirements are added to the scour POA.*

FINDING

3. Inspection Frequencies for Structurally Deficient Bridges

MDOT had not instituted a sufficient process to ensure that inspectors consistently increased the bridge inspection frequency for each structurally deficient bridge or documented an acceptable rationale for not doing so. As a result, some bridges may not have been inspected as frequently as necessary. Ensuring that structurally deficient bridges are inspected with sufficient frequency is important for maintaining the safety and confidence of the traveling public and for effectively managing the condition of the valuable assets.

NBIS sets the maximum intervals for routine, underwater, and other types of inspections. However, NBIS requires that MDOT develop criteria for inspecting certain bridges more frequently considering such factors as known deficiencies and traffic characteristics. Bridge inspectors are to utilize MDOT's criteria as a reference to verify and ensure the stability of deficient bridge elements and to ensure that there are no significant changes in a bridge's condition between inspections. In accordance with NBIS, MDOT issued Guidelines for Bridge Inspection Frequencies (Guidelines), with the latest update to the Guidelines being issued April 16, 2013.

MDOT Bridge Advisory BA-2013-01, which introduced the updated Guidelines, recommends that bridge owners and inspectors use the Guidelines to maintain consistency Statewide and to implement an increased level of inspection for structurally deficient bridges. The Guidelines, recognizing that establishing the appropriate inspection frequency for a given bridge involves engineering judgment, provide for inspectors to set a structurally deficient bridge's routine inspection frequency within 1 of 3 ranges depending on the specific conditions of each bridge (i.e., less than 24 months, less than or equal to 12 months, or less than or equal to 6 months) or increase the monitoring of only the deficient elements of a bridge through special inspections. MDOT Bridge Advisory BA-2013-01 requires that inspectors provide comments in each inspection report to justify their assigned inspection frequency.

As of May 15, 2014, 1,289 State-owned or locally owned bridges were structurally deficient. We selected 50 of these bridges and reviewed the most current routine inspection report for each bridge. We noted that bridge inspectors did not increase the routine inspection frequency, schedule special inspections, or document their rationale for not increasing the inspection frequencies for 26 (52.0%) bridges.

As part of its annual quality assurance/quality control (QA/QC) review, MDOT and a consultant contractor examined the bridge inspection frequencies for randomly selected structurally deficient bridges for adherence with the Guidelines. Similar to our findings, the 2012 and 2013 QA/QC reviews noted that 2 (40.0%) of 5 and 2 (16.7%) of 12 bridge owners, respectively, did not appropriately modify the inspection frequency for more than 50.0% of their structurally deficient bridges included in the QA/QC review.

Although we recognize the importance of professional judgment in the inspection process, we also recognize the need to exercise caution when bridges are determined to be in poor condition. This is especially significant given the financial pressures experienced by bridge owners and the potential effect of these pressures on increasing bridge owners' inspection burdens. We surveyed five states and noted that they all required annual or more frequent inspection for 100% of their structurally deficient bridges.

MDOT informed us that it is encouraging inspectors to more closely monitor deficient bridge elements through special inspections as they take significantly less effort to conduct than routine inspections. MDOT also informed us that it intends to provide additional guidance to inspectors regarding the appropriate use of special inspections.

RECOMMENDATION

We recommend that MDOT institute a sufficient process to ensure that inspectors consistently increase the bridge inspection frequencies for structurally deficient bridges or document an acceptable rationale for not doing so.

AGENCY PRELIMINARY RESPONSE

MDOT provided us with the following response:

MDOT concurs with the recommendation.

In addition to consideration of consistency, MDOT will also continue to consider engineering judgment relative to bridge inspections. The engineering judgment is based on engineers' technical knowledge of structural analysis and behavior, as well as knowledge of materials used for civil-engineering structures. The function of MDOT Bridge Inspection Program management is to develop policy and procedures that provide guidance and promote statewide consistency in inspections. However, an individual qualified inspector's engineering judgment will always have a role in the inspection process.

NBIS requires states to develop criteria for inspecting bridges at less-than-the-maximum intervals. Since the previous audit of the Bridge Inspection Program, MDOT updated the "Guidelines for Bridge Inspection Frequencies" in Bridge

Advisory BA-2013-01. MDOT subsequently released an updated version of the guidelines on November 25, 2014, which includes additional recommendations regarding in-depth inspections. Maximum frequencies are required by the NBIS. Bridge inspection frequencies that are less than the maximum are recommended based on the condition of the structure and the inspector's confidence that the structure will remain in its current condition until the next inspection cycle. The purpose of the updated frequency guidelines is to provide additional clarification for inspecting structures at less than the maximum intervals. Evaluation of the conditions encountered during the inspection for each bridge requires engineering judgment to verify the propriety of the frequencies of future inspections. The updated frequency guidelines are to be used as reference for bridge inspectors to maintain consistency statewide. MDOT recommends to bridge owners and inspectors the review and use of the Guidelines for Bridge Inspection Frequencies during MDOT's statewide QA/QC process and encourages implementation of an increased level of inspections for structures meeting the listed criteria.

By March 31, 2015, MDOT will add a data field on the inspection reports for the inspector to provide justification when the frequency recommended exceeds the frequency guideline criteria for structures that are considered structurally deficient.

FINDING

4. Inspection Timeliness

MDOT had not implemented sufficient measures to ensure that local bridge owners and MDOT regional offices completed all routine inspections, inspections of the underwater structural elements of bridges, and fracture critical member inspections in accordance with time frames established in State statute and NBIS. Also, MDOT did not sufficiently document some of its follow-up actions related to late or potentially late bridge inspections. Timely inspections help to ensure the preservation of assets and the safety of the traveling public.

Section 254.19a of the *Michigan Compiled Laws* requires MDOT to institute a systematic plan of biennial inspection of all bridges under its jurisdiction. Similarly, NBIS requires that MDOT routinely inspect, or cause to be inspected, all highway bridges at regular intervals not to exceed 24 months. NBIS also requires that the underwater structural elements of bridges that cannot be inspected during routine

inspections by wading or probing be inspected at regular intervals not to exceed 60 months. In addition, NBIS requires that fracture critical members be inspected at intervals not to exceed 24 months. Further, NBIS requires local bridge owners and MDOT regional offices to enter bridge inspection data into the Bridge Management System (BMS) within 180 days and 90 days of the bridge inspection date, respectively.

We analyzed MDOT's bridge inspection data from October 1, 2011 through May 8, 2014 and noted that local bridge owners and MDOT regional offices had not completed a total of 893 (6.4%) of 13,955 routine inspections in a timely manner. We also noted that local bridge owners had not completed 8 (5.2%) of 154 underwater bridge inspections in a timely manner. In addition, we noted that local bridge owners and MDOT regional offices had not completed 25 (13.2%) of 189 fracture critical bridge member inspections in a timely manner. Of the 926 late inspections, 891 (96.2%) were for locally owned bridges and 35 (3.8%) were for State-owned bridges as shown in the following table:

Number of Months Late	Number of Late Inspections		
	Locally Owned Bridges	State-Owned Bridges	Total
1 to 3 months	777	23	800
4 to 6 months	100	0	100
7 to 12 months	14	8	22
Over 12 months	0	4	4
Total late inspections	891	35	926

Although the number of late inspections is significant, MDOT's follow-up efforts have positively impacted overall inspection timeliness. For example, the percentage of late routine inspections dropped from 9.6%, as reported in our May 2010 audit report, to 6.4% in this audit, a 33.3% improvement in timeliness. Also, the percentage of late underwater inspections dropped from 58.9% to 5.2%, a 91.2% improvement in timeliness. In addition, the number of inspections that were more than 12 months late dropped from 132 to only 4.

After the issuance of our May 2010 audit report on MDOT's Bridge Inspection Program, which included a material condition related to untimely bridge

inspections, MDOT began sending automated e-mail reminders to bridge owners with inspections coming due within the next 90 days. Also, MDOT informed us that, in 2010, it began sending monthly automated follow-up notices to bridge owners with routine inspections that were 30 days past due. In 2012, MDOT began including bridge owners with overdue underwater and fracture critical member inspections in this notification process. In January 2014, MDOT began following up the automated notifications with telephone calls to the applicable bridge owners and/or their designated inspectors. In addition to these new efforts aimed at helping to ensure the timely completion of inspections and the input of the inspection data into BMS, MDOT continued contacting (via telephone and/or e-mail) bridge owners with bridge inspections that were 3 months or more past due and for which the related inspection data had not been entered into BMS. When MDOT learned that a bridge owner had not yet completed a required inspection or could not reach a bridge owner to determine the status of an inspection, MDOT stated that it restricted the bridge owner's access to all transportation funding for new projects until the bridge owner completed the required inspection and entered the inspection results into BMS.

We reviewed MDOT's inspection follow-up activities and noted that MDOT did not maintain documentation of when it placed and removed funding holds on delinquent bridge owners. In addition, MDOT did not maintain consistent information on which local bridge owners were subject to the funding holds.

FHWA annually assesses MDOT's bridge inspection timeliness. For the period March 1, 2013 through April 30, 2014, FHWA assessed MDOT (including local agencies) as being conditionally compliant, subject to a plan of corrective action, with NBIS routine inspection timeliness provisions. MDOT informed us that it is continuing to enhance its inspection follow-up process to further improve the timeliness of required bridge inspections.

RECOMMENDATIONS

We recommend that MDOT continue to implement additional measures to ensure that local bridge owners and MDOT regional offices complete routine inspections, inspections of the underwater structural elements of bridges, and fracture critical member inspections in accordance with time frames established in State statute and NBIS.

We also recommend that MDOT sufficiently document its follow-up actions related to late or potentially late bridge inspections.

AGENCY PRELIMINARY RESPONSE

MDOT provided us with the following response:

MDOT concurs with the recommendations.

MDOT will continue implementation of measures that it set in place to ensure that local agency bridge owners are completing inspections within the timeliness required by the NBIS. MDOT will also continue to sufficiently document follow-up actions related to late or potentially late bridge inspections.

MDOT has already taken the following actions regarding inspection timeliness:

- As part of MiSIM, Chapter 3, a 30-day inspection-report-entry procedure was implemented. The procedure requires inspectors to enter inspection results in the MiBRIDGE application within 30 days of completing the field portion of the inspection. This exceeds current FHWA requirements of 90 days for state-owned structures or 180 days for local agency owned structures.*
- As part of MiSIM, Chapter 3, "Notifications of Unassigned Inspections," MDOT issues monthly notifications to bridge owners, and qualified consultants for agencies with unassigned inspections, one month prior to the date inspection reports are due.*
- In September 2014, MDOT developed and implemented an internal process to improve the coordination of actions taken by various areas within MDOT regarding noncompliance by local agency bridge owners. As of October 1, 2014, MDOT has implemented a process to monitor inspection timeliness monthly. The process requires advertising of unassigned inspections, contacting each agency with inspections greater than one month past due, and publicly advertising a list of the agencies that have not complied with NBIS. The process prompts preparation and submission by MDOT to the local agency owner of formal notification that federal and state transportation funds will be withheld from a nonresponsive agency.*

- *MDOT Bridge Field Services staff has, on a quarterly basis, provided bridge inspection program timeliness summaries to senior management, including the chief operations officer, region engineers, and Highway Operations bureau directors for review and comment.*

FINDING

5. False Decking

MDOT did not provide consistent guidance to inspectors regarding the inspection of bridges with plywood false decking. Also, MDOT did not ensure that all bridges with false decking were correctly identified in BMS. In addition, MDOT did not adequately inspect the underside of bridges with plywood false decking. As a result of these conditions, MDOT did not consistently comply with NBIS, which was developed to help ensure the safety of the traveling public.

False decking consists of either plywood sheeting laid on timber supports (as can be seen in the following photograph) or wire mesh affixed to a metal frame. The timber supports and metal frames are supported on each end by a bridge's beams. False decking is an accepted method of preventing the broken concrete from deteriorating bridges from falling onto traffic until more permanent repairs can be made.

Photograph of Underside of Bridge Partially Covered in Plywood False Decking



Source: Photograph provided by MDOT.

As part of its comprehensive guidelines for completing bridge inspections, the AASHTO Manual requires inspectors to examine a bridge's deck and the structural members (e.g., beams, girders, and hangers) making up a bridge's superstructure as part of a routine inspection. To inspect the underside of a bridge significantly or fully obscured from view by plywood false decking, an inspector would generally have to remove some of the false decking.

MDOT provided inconsistent direction to inspectors regarding this practice. For example, until April 1, 2013, MDOT's Michigan Structure Inventory and Appraisal Coding Guide (Coding Guide) advised inspectors to rate as "not applicable" those deck bottoms that could not be inspected because of false decking. Although this provision is no longer in the Coding Guide, MDOT's NBI Rating Guidelines still contain the provision. Also, neither the Coding Guide in effect before April 1, 2013 nor the NBI Rating Guidelines addressed the inspection of the superstructure of

bridges fitted with plywood false decking. In addition, we noted that MDOT's Guidelines for Bridge Inspection Frequencies, dated April 16, 2013, require the removal of a portion of the plywood false decking only from bridges that are completely covered with plywood false decking to facilitate the inspection of the bridge's superstructure. The Guidelines do not specifically address the inspection of the underside of the bridge deck.

We requested a listing of bridges with false decking from MDOT's PM and we also queried BMS. The PM provided us with a list of 293 bridges that the MDOT regions identified as having false decking as of December 2013, whereas our query of BMS identified only 237 bridges with false decking as of February 12, 2014. We compared the lists and identified 68 bridges with false decking that were not recorded as such in BMS and 12 bridges identified as having false decking in BMS that the MDOT regions did not identify. The PM informed us that MDOT bridge maintenance staff installed and removed false decking on bridges. However, these individuals did not have access to input the necessary changes in BMS after adding or removing false decking to or from a bridge. Also, no mechanism existed for reporting this information to individuals who could make the necessary changes to the bridge files in BMS. As a result of these conditions, BMS did not accurately reflect the bridges with false decking.

From the bridge lists, we identified 277 unique bridges with either plywood or an unrecorded type of false decking. To determine if inspectors appropriately removed plywood false decking to complete their routine inspections, we reviewed the inspection reports for the most recent routine inspections for 42 bridges. These included the 12 bridges that the MDOT regions did not identify as having false decking and 30 additional selected bridges. We noted:

- a. MDOT bridge inspectors did not inspect and rate the underside of the decks for 3 (100%) of 3 bridges that were fully or almost fully covered with plywood false decking. Instead, the inspectors indicated that the condition of the underside of the decks were "not applicable" because false decking obscured them from sight. However, the MDOT inspectors rated the superstructures of the 3 bridges even though significant portions of the superstructures, like the underside of the bridges' decks, were shielded from view by plywood false decking. There was no documentation of how the inspectors derived their ratings for the superstructures. MDOT bridge

inspectors conducted 2 of the 3 inspections after MDOT removed its guidance on using the "not applicable" designation from its Coding Guide.

- b. MDOT bridge inspectors rated the underside of the decks for 16 (88.9%) of 18 bridges that were significantly covered with plywood false decking. However, the inspection reports contained no indication that MDOT removed any of the plywood false decking to facilitate the inspections of the bridges.

We noted similar conditions in our prior audit report. MDOT indicated that it concurred with the related recommendations; however, MDOT had not yet taken sufficient action to comply.

RECOMMENDATIONS

We recommend that MDOT provide consistent guidance to inspectors regarding the inspection of bridges with plywood false decking.

We also again recommend that MDOT ensure that all bridges with false decking are correctly identified in BMS.

We further recommend that MDOT adequately inspect the underside of bridges with plywood false decking.

AGENCY PRELIMINARY RESPONSE

MDOT provided us with the following response:

MDOT concurs with the recommendations.

For bridge decks that are completely false decked with timber, a portion must be removed for inspection purposes. MDOT then considers replacing the timber false decking with metal mesh panels. The use of metal mesh panels facilitates the inspection of the underside of the bridge deck. It is rare that the underside of a bridge deck is completely false decked. Generally, false decking is used over traveled roadway (driving lanes and shoulders) to protect the public. Often, significant portions of the underside of the deck are still visible for inspection (such as the spans over slope paving between the abutments and adjacent piers). In

most cases, the remaining portion of the deck soffit and superstructure is exposed for the inspector to ascertain the overall condition of the components. In some cases, there are structures that are completely false decked under the deck soffit, and, in these cases, the current policy requires a representative amount of false decking to be removed to verify the condition of the components. Therefore, in regard to the third recommendation of this finding, MDOT is able to effectively inspect and rate bridges with false decking without requiring all of the false decking be removed.

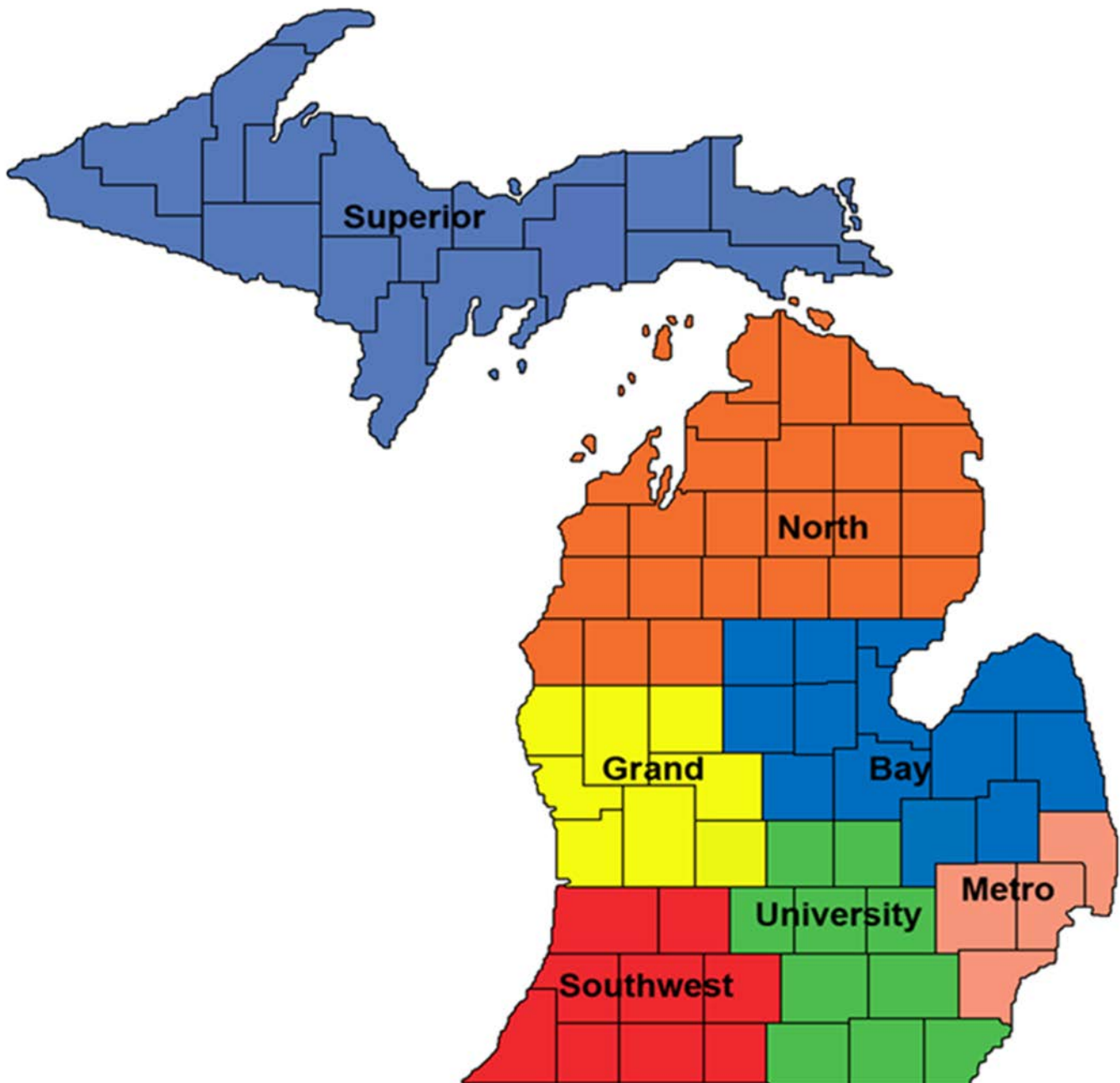
MDOT has already taken the following actions regarding false decking:

- MDOT has provided additional guidance to the inspectors for the inspection of structures containing false decking. This guidance is incorporated in the Routine Inspection Procedures section of the MiSIM, and was also released as part of the Bridge Advisory "Guidelines for Bridge Inspection Frequencies," BA-2013-01, which was released in April 2013.*
- MDOT has already implemented the new AASHTO element inspection procedures, which will document and track quantities of false decking on the State Trunkline system. MDOT created two new agency-developed elements to track the condition, type, and amount of false decking material that is placed below the bridge deck.*

In addition to the improvements already made, by July 31, 2015, MDOT will update the inspection reports to provide a data field for the inspector to document when an inspection resulted in the removal of false decking.

SUPPLEMENTAL INFORMATION

BRIDGE INSPECTION PROGRAM
Michigan Department of Transportation (MDOT)
Map of MDOT Regions
As of June 1, 2014



Source: www.michigan.gov

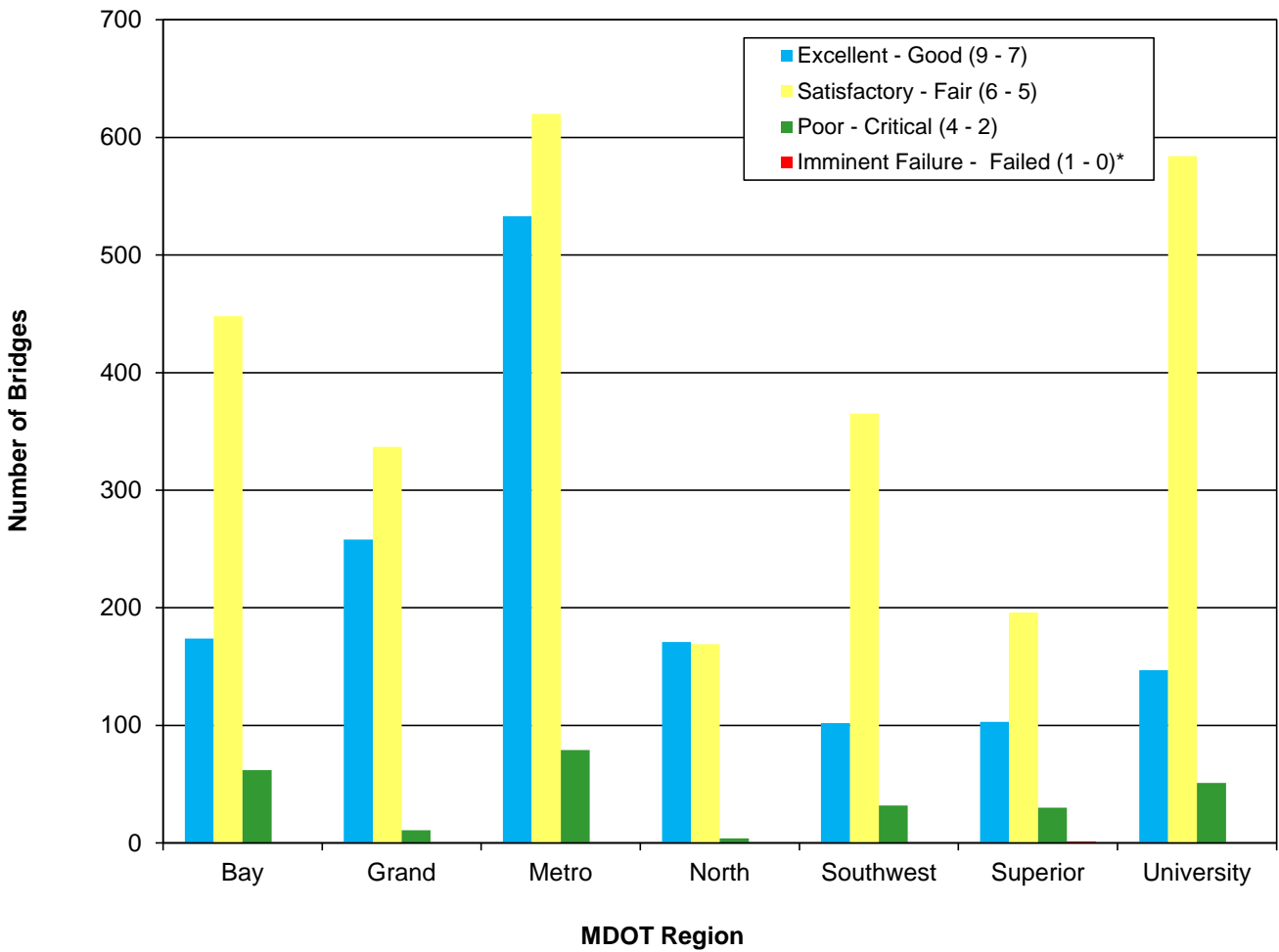
BRIDGE INSPECTION PROGRAM
Michigan Department of Transportation (MDOT)
FHWA Bridge Condition Rating Guidelines
As of June 1, 2014

Code	Description
N	Not applicable
9	Excellent condition
8	Very good condition - No problems noted.
7	Good condition - Some minor problems noted.
6	Satisfactory condition - Structural elements show some minor deterioration.
5	Fair condition - All primary structural elements are sound but may have minor section loss, cracking, spalling, or scour.
4	Poor condition - Advanced section loss, deterioration, spalling, or scour.
3	Serious condition - Loss of section, deterioration, spalling, or scour have seriously affected primary structural components. Local failures are possible. Fatigue cracks in steel or shear cracks in concrete may be present.
2	Critical condition - Advanced deterioration of primary structural elements. Fatigue cracks in steel or shear cracks in concrete may be present or scour may have removed substructure support. Unless closely monitored, it may be necessary to close the bridge until corrective action is taken.
1	"Imminent" failure condition - Major deterioration or section loss present in critical structural components, or obvious vertical or horizontal movement affecting structure stability. Bridge is closed to traffic but corrective action may put bridge back in light service.
0	Failed condition - Out of service; beyond corrective action.

Source: Federal Highway Administration Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation's Bridges.

BRIDGE INSPECTION PROGRAM
Michigan Department of Transportation (MDOT)

Chart of Overall Condition Ratings of State-Owned National Bridge Inventory Bridges, by MDOT Region
As of April 30, 2014



* Bridges are either not in service or temporarily supported.

Source: The Office of the Auditor General prepared this exhibit based on data queried from MDOT's Bridge Management System using the MiBridge Web application.

BRIDGE INSPECTION PROGRAM
Michigan Department of Transportation (MDOT)

Overall Condition Ratings of State-Owned National Bridge Inventory Bridges, by MDOT Region
As of April 30, 2014

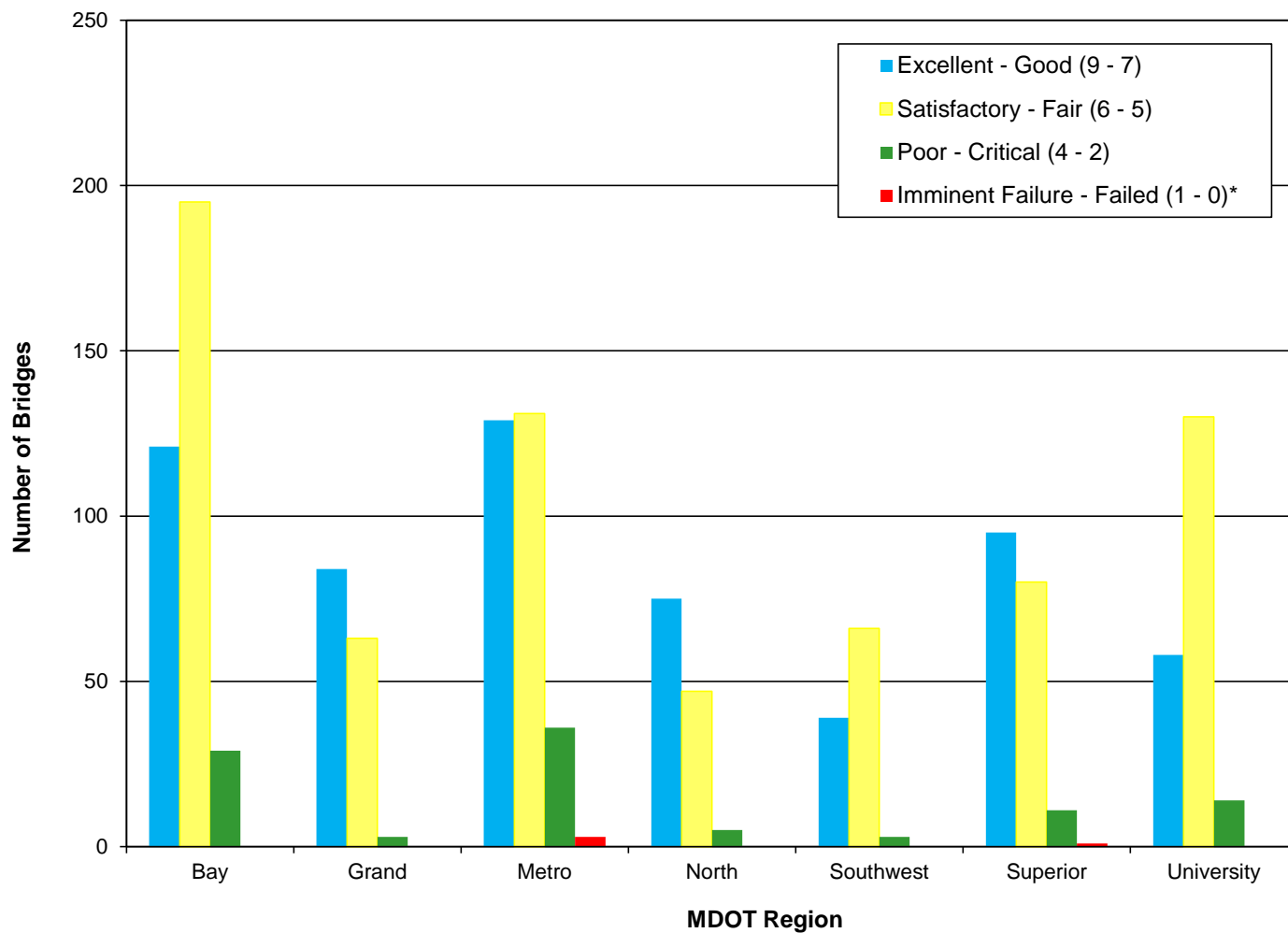
MDOT Region	Excellent - Good (9 - 7)	Satisfactory - Fair (6 - 5)	Poor - Critical (4 - 2)	Imminent Failure - Failed (1 - 0)*	Total Bridges
Bay	174	448	62	0	684
Grand	258	337	11	0	606
Metro	533	620	79	0	1,232
North	171	169	4	0	344
Southwest	102	365	32	0	499
Superior	103	196	30	1	330
University	147	584	51	0	782
Total	<u>1,488</u>	<u>2,719</u>	<u>269</u>	<u>1</u>	<u>4,477</u>

* Bridge is not in service.

Source: The Office of the Auditor General prepared this exhibit based on data queried from MDOT's Bridge Management System using the MiBridge Web application.

BRIDGE INSPECTION PROGRAM
Michigan Department of Transportation (MDOT)

Chart of Overall Condition Ratings of State-Owned Non-National Bridge Inventory Bridges, by MDOT Region
As of April 30, 2014



* Bridges are either not in service or temporarily supported.

Source: The Office of the Auditor General prepared this exhibit based on data queried from MDOT's Bridge Management System using the MiBridge Web application.

BRIDGE INSPECTION PROGRAM
Michigan Department of Transportation (MDOT)

Overall Condition Ratings of State-Owned Non-National Bridge Inventory Bridges, by MDOT Region
As of April 30, 2014

MDOT Region	Excellent - Good (9 - 7)	Satisfactory - Fair (6 - 5)	Poor - Critical (4 - 2)	Imminent Failure - Failed (1 - 0)*	Total Bridges
Bay	121	195	29	0	345
Grand	84	63	3	0	150
Metro	129	131	36	3	299**
North	75	47	5	0	127
Southwest	39	66	3	0	108
Superior	95	80	11	1	187
University	58	130	14	0	202
Total	601	712	101	4	1,418

* Bridges are either not in service or temporarily supported.

** This count excludes 2 bridges that did not receive a quantifiable rating.

Source: The Office of the Auditor General prepared this exhibit based on data queried from MDOT's Bridge Management System using the MiBridge Web application.

BRIDGE INSPECTION PROGRAM
Michigan Department of Transportation (MDOT)

Overall Condition Ratings of Municipality-Owned National Bridge Inventory Bridges
As of April 30, 2014

Municipality	Excellent - Good (9 - 7)	Satisfactory - Fair (6 - 5)	Poor - Critical (4 - 2)	Total Bridges
Adrian	0	7	0	7
Alanson	1	0	0	1
Albion	5	3	1	9
Algonac	0	5	0	5
Allegan	1	2	0	3
Allen Park	0	2	0	2
Alma	2	1	0	3
Almont	1	0	0	1
Alpena	1	1	0	2
Ann Arbor	8	7	0	15
Armada	2	1	1	4
Auburn Hills	4	1	0	5
Augusta	0	2	0	2
Baldwin	0	0	1	1
Bangor	0	4	0	4
Baroda	1	1	0	2
Barryton	1	0	0	1
Battle Creek	16	2	0	18
Bay City	1	1	1	3
Beaverton	0	0	1	1
Belding	3	0	1	4
Bellaire	1	1	0	2
Bellevue	0	2	0	2
Benton Harbor	4	4	1	9
Bessemer	0	1	0	1
Beverly Hills	4	1	0	5
Big Rapids	2	0	1	3
Bingham Farms	1	0	0	1
Birch Run	0	1	0	1
Birmingham	11	1	0	12
Bloomfield Hills	3	1	0	4
Boyne City	2	0	0	2
Breedsville	0	1	0	1
Brooklyn	0	1	0	1
Buchanan	1	0	0	1
Burr Oak	2	0	0	2

This exhibit is continued on next page.

BRIDGE INSPECTION PROGRAM
Michigan Department of Transportation (MDOT)

Overall Condition Ratings of Municipality-Owned National Bridge Inventory Bridges
As of April 30, 2014

Municipality	Excellent - Good (9 - 7)	Satisfactory - Fair (6 - 5)	Poor - Critical (4 - 2)	Total Bridges
Burton	7	2	1	10
Byron	1	3	0	4
Cadillac	3	2	1	6
Caro	0	1	0	1
Caspian	4	0	0	4
Cedar Springs	0	1	0	1
Cement City	1	0	0	1
Central Lake	1	0	0	1
Centreville	1	0	0	1
Cheboygan	1	0	0	1
Clare	0	1	0	1
Clearwater Township	0	0	1	1
Clio	0	1	0	1
Coldwater	3	3	0	6
Columbiaville	0	0	2	2
Concord	1	1	0	2
Constantine	1	0	0	1
Coopersville	1	2	1	4
Corunna	1	0	0	1
Croswell	1	0	1	2
Crystal Falls	0	1	0	1
Custer	1	0	0	1
Dearborn	3	1	0	4
Dearborn Heights	9	5	0	14
Detroit	13	11	5	29
DeWitt	1	1	0	2
Dimondale	1	0	0	1
Douglas	0	1	0	1
Dowagiac	2	4	0	6
East Lansing	1	2	0	3
Eaton Rapids	0	4	0	4
Elk Rapids	1	0	0	1
Escanaba	3	1	0	4
Evart	1	0	0	1
Fairgrove	1	0	0	1
Farmington	0	2	0	2

This exhibit is continued on next page.

BRIDGE INSPECTION PROGRAM
Michigan Department of Transportation (MDOT)

Overall Condition Ratings of Municipality-Owned National Bridge Inventory Bridges
As of April 30, 2014

Municipality	Excellent - Good (9 - 7)	Satisfactory - Fair (6 - 5)	Poor - Critical (4 - 2)	Total Bridges
Fenton	1	4	1	6
Ferrysburg	1	1	0	2
Flint	9	12	12	33
Flushing	0	1	0	1
Fowlerville	1	1	0	2
Freeport	0	1	0	1
Fruitport	1	1	0	2
Gibraltar	2	3	3	8
Goodrich	0	1	0	1
Grand Blanc	1	3	0	4
Grand Haven	1	0	0	1
Grand Rapids	13	7	2	22
Grandville	0	5	0	5
Greenville	2	1	0	3
Harrietta	1	0	0	1
Hart	0	0	1	1
Hastings	1	0	0	1
Hersey	1	0	0	1
Hesperia	2	0	0	2
Holland	3	3	0	6
Hopkins	1	0	0	1
Howard City	1	1	0	2
Hubbardston	1	1	0	2
Hudson	0	2	0	2
Hudsonville	4	3	1	8
Inkster	1	0	0	1
Iron River	5	1	0	6
Ironwood	2	0	0	2
Ishpeming	4	0	0	4
Ithaca	1	0	0	1
Jackson	3	8	4	15
Kalamazoo	13	5	1	19
Keego Harbor	0	1	0	1
Kent City	1	1	2	4
Kentwood	9	1	0	10
Lake Orion	2	0	0	2

This exhibit is continued on next page.

BRIDGE INSPECTION PROGRAM
Michigan Department of Transportation (MDOT)

Overall Condition Ratings of Municipality-Owned National Bridge Inventory Bridges
As of April 30, 2014

Municipality	Excellent - Good (9 - 7)	Satisfactory - Fair (6 - 5)	Poor - Critical (4 - 2)	Total Bridges
L'Anse	4	0	0	4
Lansing	8	6	5	19
Lapeer	7	4	2	13
Lawrence	2	1	0	3
Leslie	0	1	0	1
Lincoln Park	3	2	4	9
Linden	1	1	0	2
Litchfield	1	0	0	1
Livonia	0	2	0	2
Ludington	1	0	0	1
Luna Pier	1	0	0	1
Lyons	0	1	0	1
Manchester	0	1	1	2
Manistee	0	1	0	1
Maple Rapids	0	1	0	1
Marine City	1	0	0	1
Marion	0	0	1	1
Marquette	1	2	0	3
Marshall	0	2	2	4
Mason	0	2	0	2
Mattawan	0	1	0	1
Menominee	0	1	1	2
Metro Airport	9	5	0	14
Michigan State University	0	2	0	2
Middleville	2	0	1	3
Midland	5	4	3	12
Milan	0	2	0	2
Milford	3	1	0	4
Millersburg	0	1	0	1
Monroe	1	3	1	5
Morenci	1	0	1	2
Morley	1	0	0	1
Mount Clemens	0	1	1	2
Mount Pleasant	0	2	1	3
Muir	0	0	1	1
Munising	0	1	0	1

This exhibit is continued on next page.

BRIDGE INSPECTION PROGRAM
Michigan Department of Transportation (MDOT)

Overall Condition Ratings of Municipality-Owned National Bridge Inventory Bridges
As of April 30, 2014

Municipality	Excellent - Good (9 - 7)	Satisfactory - Fair (6 - 5)	Poor - Critical (4 - 2)	Total Bridges
Muskegon	1	1	1	3
Nashville	0	1	0	1
Negaunee	0	1	0	1
New Baltimore	0	2	1	3
New Buffalo	0	1	0	1
New Haven	1	0	0	1
New Lothrop	1	1	0	2
Newaygo	1	0	0	1
Niles	0	1	2	3
North Muskegon	0	1	0	1
Northville	2	1	0	3
Norton Shores	2	3	0	5
Novi	2	2	0	4
Olivet	1	1	0	2
Ortonville	1	1	1	3
Otsego	2	0	0	2
Ovid	0	2	0	2
Owosso	1	1	0	2
Paw Paw	2	1	0	3
Petoskey	1	2	1	4
Pinconning	1	0	0	1
Plainwell	1	3	0	4
Pontiac	3	5	1	9
Port Austin	0	1	0	1
Port Huron	1	2	0	3
Portage	2	0	1	3
Portland	1	1	1	3
Powers	1	0	0	1
Ravenna	1	0	0	1
Reed City	0	1	0	1
Rochester	4	0	0	4
Rochester Hills	4	0	0	4
Rockford	1	0	2	3
Rogers City	0	1	0	1
Rose City	1	0	0	1
Saginaw	3	3	1	7

This exhibit is continued on next page.

BRIDGE INSPECTION PROGRAM
Michigan Department of Transportation (MDOT)

Overall Condition Ratings of Municipality-Owned National Bridge Inventory Bridges
As of April 30, 2014

Municipality	Excellent - Good (9 - 7)	Satisfactory - Fair (6 - 5)	Poor - Critical (4 - 2)	Total Bridges
Saline	0	3	0	3
Sanford	0	1	0	1
Saranac	4	1	0	5
Sault Ste Marie	3	1	3	7
Sebewaing	3	0	0	3
Shepherd	1	0	0	1
South Haven	0	0	1	1
Southfield	8	5	2	15
Sparta	0	1	1	2
St. Clair Shores	3	1	0	4
St. Joseph	0	1	0	1
St. Louis	3	0	0	3
Standish	1	0	0	1
Stephenson	2	1	0	3
Sterling Heights	8	2	1	11
Stevensville	1	0	0	1
Swartz Creek	2	0	0	2
Sylvan Lake	0	1	0	1
Tawas City	0	4	0	4
Taylor	4	0	0	4
Tecumseh	1	4	0	5
Three Oaks	0	1	0	1
Three Rivers	0	6	1	7
Traverse City	2	3	2	7
Trenton	0	2	0	2
Troy	4	6	1	11
Ubly	1	1	0	2
Union City	0	2	0	2
Utica	1	0	0	1
Vassar	0	1	0	1
Vernon	0	2	1	3
Wakefield	3	1	0	4
Walker	1	2	1	4
Warren	2	2	0	4
Watervliet	0	2	0	2
Wayne	1	2	0	3

This exhibit is continued on next page.

BRIDGE INSPECTION PROGRAM
Michigan Department of Transportation (MDOT)

Overall Condition Ratings of Municipality-Owned National Bridge Inventory Bridges
As of April 30, 2014

Municipality	Excellent - Good (9 - 7)	Satisfactory - Fair (6 - 5)	Poor - Critical (4 - 2)	Total Bridges
West Branch	2	2	0	4
Western Michigan University	1	0	0	1
Westland	1	3	0	4
Williamston	1	0	1	2
Wolverine	0	1	2	3
Wolverine Lake	1	0	0	1
Woodhaven	1	0	0	1
Wyoming	3	3	3	9
Yale	1	1	0	2
Ypsilanti	0	2	3	5
Zeeland	1	0	0	1
Total	395	334	107	836
Percentage of total	47.2%	40.0%	12.8%	100.0%

Source: The Office of the Auditor General prepared this exhibit based on data queried from MDOT's Bridge Management System using the MiBridge Web application.

BRIDGE INSPECTION PROGRAM
Michigan Department of Transportation (MDOT)

Overall Condition Ratings of County-Owned National Bridge Inventory Bridges
As of April 30, 2014

County	Excellent - Good (9 - 7)	Satisfactory - Fair (6 - 5)	Poor - Critical (4 - 2)	Imminent Failure - Failed (1 - 0)*	Total Bridges
Alcona	13	8	4	0	25
Alger	16	8	4	2	30
Allegan	73	50	25	0	148
Alpena	9	10	2	0	21
Antrim	6	3	1	0	10
Arenac	15	26	5	0	46
Baraga	28	12	2	0	42
Barry	6	14	5	0	25
Bay	23	45	10	0	78
Benzie	5	8	2	1	16
Berrien	52	34	16	0	102
Branch	24	32	22	0	78
Calhoun	26	38	21	0	85
Cass	12	6	11	0	29
Charlevoix	6	2	1	0	9
Cheboygan	18	9	3	0	30
Chippewa	21	24	10	0	55
Clare	26	12	3	1	42
Clinton	49	47	23	1	120
Crawford	7	7	6	0	20
Delta	18	26	12	0	56
Dickinson	13	10	1	0	24
Eaton	67	18	9	1	95
Emmet	5	6	4	0	15
Genesee	28	54	38	0	120
Gladwin	27	16	3	0	46
Gogebic	18	26	17	0	61
Grand Traverse	13	5	1	0	19
Gratiot	59	43	17	0	119
Hillsdale	32	43	17	0	92
Houghton	24	7	2	0	33
Huron	105	55	5	0	165
Ingham	18	23	24	0	65
Ionia	28	25	12	1	66
Iosco	9	17	4	0	30
Iron	10	8	3	0	21
Isabella	58	28	28	0	114
Jackson	35	21	6	2	64
Kalamazoo	26	30	3	0	59
Kalkaska	5	3	2	0	10

This exhibit is continued on next page.

BRIDGE INSPECTION PROGRAM
Michigan Department of Transportation (MDOT)

Overall Condition Ratings of County-Owned National Bridge Inventory Bridges
As of April 30, 2014

County	Excellent - Good (9 - 7)	Satisfactory - Fair (6 - 5)	Poor - Critical (4 - 2)	Imminent Failure - Failed (1 - 0)*	Total Bridges
Kent	119	49	0	0	168
Keweenaw	1	2	0	0	3
Lake	5	12	5	0	22
Lapeer	35	43	14	1	93
Leelanau	0	1	0	0	1
Lenawee	126	39	13	0	178
Livingston	36	32	22	1	91
Luce	14	1	4	0	19
Mackinac	12	6	3	0	21
Macomb	151	33	29	0	213
Manistee	8	12	3	1	24 **
Marquette	33	26	30	1	90
Mason	16	8	16	0	40
Mecosta	12	6	7	0	25
Menominee	33	26	12	0	71
Midland	30	28	16	0	74
Missaukee	8	16	11	0	35
Monroe	58	73	36	1	168
Montcalm	46	30	8	0	84
Montmorency	8	3	0	0	11
Muskegon	20	25	13	1	59
Newaygo	17	25	13	0	55
Oakland	43	40	16	1	100
Oceana	29	18	8	0	55
Ogemaw	6	2	1	0	9
Ontonagon	16	7	3	0	26
Osceola	29	11	4	0	44
Oscoda	6	5	1	0	12
Otsego	3	0	0	0	3
Ottawa	93	39	2	0	134
Presque Isle	17	6	3	0	26
Roscommon	3	7	2	0	12
Saginaw	98	59	48	1	206
Sanilac	83	54	4	0	141
Schoolcraft	8	7	2	0	17
Shiawassee	68	30	8	0	106
St. Clair	111	82	25	1	219
St. Joseph	32	48	14	0	94
Tuscola	142	49	14	0	205

This exhibit is continued on next page.

BRIDGE INSPECTION PROGRAM
Michigan Department of Transportation (MDOT)

Overall Condition Ratings of County-Owned National Bridge Inventory Bridges
As of April 30, 2014

County	Excellent - Good (9 - 7)	Satisfactory - Fair (6 - 5)	Poor - Critical (4 - 2)	Imminent Failure - Failed (1 - 0)*	Total Bridges
Van Buren	35	26	3	0	64
Washtenaw	44	33	33	1	111
Wayne	109	112	12	0	233
Wexford	11	4	2	0	17
Total	2,807	1,994	844	19	5,664
Percentage of Total	49.6%	35.2%	14.9%	0.3%	100.0%

* Bridges are either not in service or temporarily supported.

** This count excludes 1 bridge that did not receive a quantifiable rating.

Source: The Office of the Auditor General prepared this exhibit based on data queried from MDOT's Bridge Management System using the MiBridge Web application.

BRIDGE INSPECTION PROGRAM
Michigan Department of Transportation (MDOT)

Scour Ratings for State-Owned and Locally Owned Scour Critical Bridges
As of March 28, 2014

<u>MDOT Region/Local Agency Bridge Owner</u>	<u>Bridge Foundation Unstable (3 - 2)</u>	<u>Bridge Closed and Failure Imminent (1 - 0)</u>	<u>Unknown Foundation</u>	<u>Total Bridges</u>
MDOT Region				
Bay	78	0	10	88
Grand	64	0	3	67
Metro	24	0	0	24
North	37	0	11	48
Southwest	46	0	5	51
Superior	52	0	20	72
University	67	0	5	72
Total MDOT regions	<u>368</u>	<u>0</u>	<u>54</u>	<u>422</u>
Local Agency				
Adrian	6	0	1	7
Albion	2	0	0	2
Alcona County	0	0	1	1
Alger County	2	0	0	2
Allegan County	14	0	3	17
Allen Park	1	0	0	1
Alpena County	4	0	3	7
Antrim County	4	0	0	4
Arenac County	25	0	0	25
Auburn Hills	1	0	0	1
Augusta	0	0	1	1
Baldwin	1	0	0	1
Bangor	0	0	1	1
Baraga County	2	0	0	2
Baroda	1	0	0	1
Barry County	2	0	2	4
Bay City	2	0	0	2
Bay County	19	1	18	38
Bellevue	0	0	1	1
Benton Harbor	0	0	1	1
Berrien County	6	0	0	6
Beverly Hills	1	0	0	1
Branch County	9	0	13	22
Burton	2	0	0	2
Cadillac	2	0	0	2
Calhoun County	8	0	41	49
Caspian	1	0	0	1
Cass County	8	0	5	13
Charlevoix County	1	0	0	1
Cheboygan County	20	0	0	20
Chippewa County	6	0	0	6
Clare	0	0	1	1

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BRIDGE INSPECTION PROGRAM
Michigan Department of Transportation (MDOT)

Scour Ratings for State-Owned and Locally Owned Scour Critical Bridges
As of March 28, 2014

MDOT Region/Local Agency Bridge Owner	Bridge Foundation Unstable (3 - 2)	Bridge Closed and Failure Imminent (1 - 0)	Unknown Foundation	Total Bridges
Clare County	4	0	1	5
Clinton County	36	0	0	36
Coldwater	0	0	1	1
Columbiaville	2	0	0	2
Coopersville	2	0	0	2
Dearborn	1	0	0	1
Dearborn Heights	2	0	0	2
Delta County	3	0	0	3
Detroit	2	0	0	2
DeWitt	2	0	0	2
Dickinson County	9	0	0	9
Dimondale	1	0	0	1
Eaton County	8	0	35	43
Eaton Rapids	3	0	0	3
Emmet County	1	0	0	1
Fairgrove	1	0	0	1
Farmington	0	0	2	2
Fenton	2	0	0	2
Flint	1	0	0	1
Genesee County	83	1	1	85
Gibraltar	4	0	0	4
Gladwin County	8	0	0	8
Gogebic County	26	0	0	26
Goodrich	1	0	0	1
Grand Blanc	0	0	3	3
Grand Rapids	1	0	1	2
Grand Traverse County	1	0	0	1
Grandville	2	0	1	3
Gratiot County	29	0	18	47
Hillsdale County	14	0	1	15
Holland	4	0	0	4
Hudsonville	0	0	1	1
Huron County	17	0	46	63
Ionia County	5	0	12	17
Iosco County	19	0	0	19
Iron County	8	0	0	8
Isabella County	20	0	9	29
Jackson	0	0	1	1
Jackson County	26	0	0	26
Kalamazoo County	0	0	1	1
Kent City	1	0	2	3
Kent County	11	0	0	11

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BRIDGE INSPECTION PROGRAM
Michigan Department of Transportation (MDOT)

Scour Ratings for State-Owned and Locally Owned Scour Critical Bridges
As of March 28, 2014

MDOT Region/Local Agency Bridge Owner	Bridge Foundation Unstable (3 - 2)	Bridge Closed and Failure Imminent (1 - 0)	Unknown Foundation	Total Bridges
Lake Orion	1	0	0	1
Lansing	14	0	0	14
Lapeer	3	0	0	3
Lapeer County	12	0	0	12
Lenawee County	8	0	0	8
Leslie	1	0	0	1
Lincoln Park	3	0	0	3
Linden	1	0	0	1
Livingston County	14	0	28	42
Livonia	1	0	0	1
Macomb County	4	0	0	4
Manistee County	2	1	0	3
Marquette County	32	0	1	33
Marshall	1	0	1	2
Mason	1	0	0	1
Mason County	1	0	13	14
Mecosta County	6	0	0	6
Menominee County	26	0	0	26
Michigan State University	2	0	0	2
Middleville	0	0	1	1
Midland	5	0	0	5
Midland County	13	0	9	22
Milford	1	0	0	1
Millersburg	0	0	1	1
Missaukee County	3	0	0	3
Monroe County	46	0	0	46
Montcalm County	6	0	6	12
Morenci	1	0	0	1
Mount Clemens	2	0	0	2
Muir	0	0	1	1
Munising	1	0	0	1
Muskegon	0	0	1	1
Muskegon County	7	0	0	7
New Buffalo	1	0	0	1
Newaygo County	2	0	7	9
Novi	0	0	2	2
Oakland County	7	0	6	13
Oceana County	8	0	0	8
Ogemaw County	1	0	0	1
Ontonagon County	3	0	0	3
Oscoda County	3	0	0	3
Portage	1	0	0	1

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BRIDGE INSPECTION PROGRAM
Michigan Department of Transportation (MDOT)

Scour Ratings for State-Owned and Locally Owned Scour Critical Bridges
As of March 28, 2014

MDOT Region/Local Agency Bridge Owner	Bridge Foundation Unstable (3 - 2)	Bridge Closed and Failure Imminent (1 - 0)	Unknown Foundation	Total Bridges
Presque Isle County	1	0	3	4
Reed City	0	0	1	1
Rochester Hills	4	0	0	4
Rockford	0	0	2	2
Roscommon County	3	0	0	3
Saginaw	1	0	0	1
Saginaw County	64	0	35	99
Sanilac County	25	0	0	25
Sault Ste Marie	1	0	0	1
Sebewaing	1	0	0	1
Shiawassee County	11	0	0	11
Southfield	6	0	0	6
Sparta	1	0	1	2
St. Clair County	3	0	0	3
St. Joseph County	0	0	1	1
St. Louis	1	0	0	1
Sterling Heights	3	0	0	3
Tawas City	4	0	0	4
Tecumseh	1	0	0	1
Tuscola County	27	0	0	27
Utica	1	0	0	1
Van Buren County	1	0	1	2
Vernon	2	0	0	2
Walker	0	0	1	1
Washtenaw County	13	0	7	20
Westland	1	0	0	1
Wexford County	2	0	0	2
Williamston	1	0	0	1
Woodhaven	0	0	1	1
Wyoming	1	0	0	1
Ypsilanti	1	0	1	2
Total local agencies	<u>934</u>	<u>3</u>	<u>359</u>	<u>1,296</u>
Grand total	<u>1,302</u>	<u>3</u>	<u>413</u>	<u>1,718</u>
Percentage of total	75.8%	0.2%	24.0%	100.0%

Source: The Office of the Auditor General prepared this exhibit based on data queried from MDOT's Bridge Management System using the MiBridge Web application.

GLOSSARY

Glossary of Abbreviations and Terms

AASHTO	American Association of State Highway and Transportation Officials.
AASHTO Manual	The Manual for Bridge Evaluation.
BMS	Bridge Management System.
condition rating	The result of the assessment of the functional capability and the physical condition of bridge components by considering the extent of deterioration and other defects.
culvert	A pipe or small structure used for drainage under a road, railroad, or other embankment. A culvert with a span length greater than 20 feet is included in the NBI and receives a rating using the NBI scale.
damage inspection	An unscheduled inspection to assess structural damage resulting from environmental factors or human actions.
deck	The portion of the bridge that directly carries traffic.
effectiveness	Success in achieving mission and goals.
false decking	Plywood sheeting laid on timbers that are supported on each end by a bridge's beams or wire mesh affixed to a metal frame. False decking is used to prevent broken concrete from a deteriorating bridge from falling onto traffic.
FHWA	Federal Highway Administration.

fracture critical member inspection	A hands-on inspection of a fracture critical member (i.e., a steel member in tension, or with a tension element, whose failure would probably cause a portion of or the entire bridge to collapse) or member components that may include visual and other nondestructive evaluation.
HEC	Hydraulic Engineering Circular.
in-depth inspection	A close-up inspection of one or more structural members above or below the water level to identify any deficiencies not readily detectable using routine inspection procedures; hands-on inspection may be necessary at some locations.
initial inspection	The first inspection of a bridge as it becomes a part of the bridge file to provide all structure inventory and appraisal data and other relevant data and to determine baseline structural conditions.
load rating	The determination of the load-carrying capacity of a bridge using bridge plans and supplemented by information gathered from a field inspection.
locally owned bridge	A bridge owned by a local governmental agency. This agency may be a city, village, township, or county.
material condition	A matter that, in the auditor's judgment, is more severe than a reportable condition and could impair the ability of management to operate a program in an effective and efficient manner and/or could adversely affect the judgment of an interested person concerning the effectiveness and efficiency of the program.
MDOT	Michigan Department of Transportation.
MiSIM	Michigan Structure Inspection Manual.

National Bridge Inspection Standards (NBIS)	Federal regulations (specifically, Title 23, Part 650 of the <i>Code of Federal Regulations</i>) establishing requirements for inspection procedures, frequency of inspections, qualifications of personnel, inspection reports, and preparation and maintenance of bridge inventory records.
National Bridge Inventory (NBI)	The aggregation of structure inventory and appraisal data collected to fulfill the requirements of NBIS. Each state shall prepare and maintain an inventory of all bridges subject to NBIS.
performance audit	An audit that provides findings or conclusions based on an evaluation of sufficient, appropriate evidence against criteria. Performance audits provide objective analysis to assist management and those charged with governance and oversight in using the information to improve program performance and operations, reduce costs, facilitate decision making by parties with responsibility to oversee or initiate corrective action, and contribute to public accountability.
plan of action (POA)	A plan to monitor known and potential deficiencies and to address critical findings caused by scour.
program manager (PM)	The individual responsible for the Bridge Inspection Program who has been assigned or delegated the duties and responsibilities for bridge inspection, reporting, and inventory. The PM provides overall leadership and is available to inspection team leaders to provide guidance.
quality assurance (QA)	The use of sampling and other measures to ensure the adequacy of quality control procedures in order to verify or measure the quality level of the entire bridge inspection and load rating program.
quality control (QC)	Procedures that are intended to maintain the quality of a bridge inspection and load rating at or above a specified level.

reportable condition	A matter that, in the auditor's judgment, is less severe than a material condition and falls within any of the following categories: an opportunity for improvement within the context of the audit objectives; a deficiency in internal control that is significant within the context of the audit objectives; all instances of fraud; illegal acts unless they are inconsequential within the context of the audit objectives; significant violations of provisions of contracts or grant agreements; and significant abuse that has occurred or is likely to have occurred.
routine inspection	A regularly scheduled inspection consisting of observations and/or measurements needed to determine the physical and functional condition of the bridge, to identify any changes from initial or previously recorded conditions, and to ensure that the structure continues to satisfy present service requirements.
scour	Erosion of streambed or bank material caused by flowing water, often considered to be localized around bridge piers and abutments.
scour critical bridge	A bridge with a foundation element that has been determined to be unstable for the observed or evaluated scour condition.
special inspection	An inspection scheduled at the discretion of the bridge owner, used to monitor a particular known or suspected deficiency.
structurally deficient	A highway bridge whose deck, superstructure, substructure, or culvert is rated in "poor condition" (0 to 4 on the NBI rating scale). A bridge can also be classified as structurally deficient if its load carrying capacity is significantly below current design standards or if a waterway below frequently overtops the bridge during floods.

substructure	The portion of the bridge that supports the superstructure and distributes all bridge loads to below-ground bridge footings.
superstructure	The portion of the bridge that supports the deck and connects one substructure element to another.
underwater inspection	Inspection of the underwater portion of a bridge substructure and the surrounding channel, which cannot be inspected visually at low water by wading or probing, generally requiring diving or other appropriate techniques.

